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HISTORY OF CHRYSLER CORPORATION GAS TURBINE VEHICLES-MARCH 1954-JANUARY 1964

Chrysler Corporation
Detroit, Michigan

January 1964

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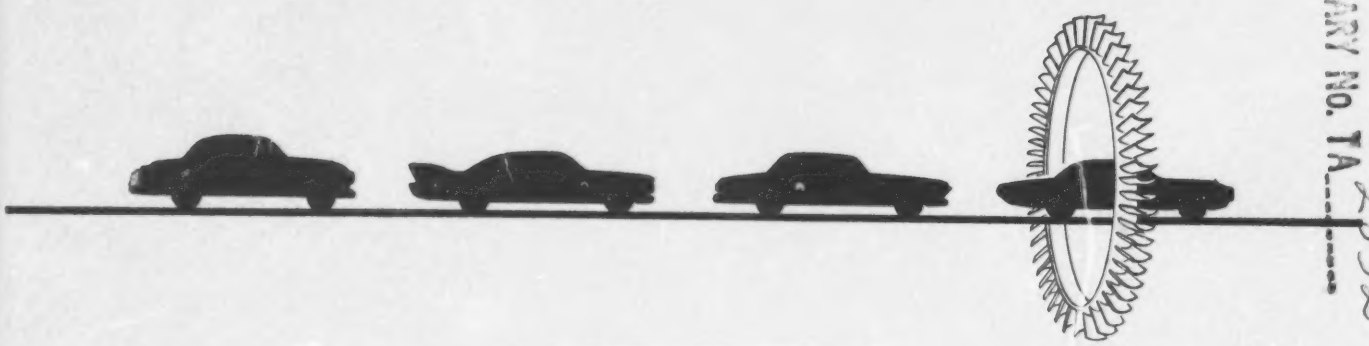

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History of Chrysler Corporation GAS TURBINE VEHICLES

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ENGINEERING STAFF
CHRYSLER CORPORATION

Technical Information Section

HISTORY

of

CHRYSLER CORPORATION

GAS TURBINE VEHICLES

MARCH 1954 - JANUARY 1964

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A review of gas turbine-powered vehicles
shown publicly by Chrysler Corporation.

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CHRYSLER CORPORATION
ENGINEERING STAFF
Technical Information Section

January, 1964

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HISTORY of

CHRYSLER CORPORATION GAS TURBINE VEHICLES

MARCH 1954 - JANUARY 1964

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EARLY INVESTIGATIONS AND RESEARCH

At Chrysler Corporation, the earliest work on gas turbine engines dates back to before World War II, when an exploratory engineering survey was conducted. These studies showed that, although the gas turbine engine had strong possibilities of being an ideal automobile engine, neither materials nor techniques had advanced to the point where the cost and time of intensive research would be warranted.

At the close of World War II, studies of completely new concepts in gas turbine design were started. As a result of this work, Chrysler was awarded, in the fall of 1945, a research and development contract by the Bureau of Aeronautics of the U. S. Navy to create a turboprop engine for aircraft. This program--although terminated in 1949--resulted in the development of a turboprop engine which achieved fuel economy approaching that of aircraft piston engines.

Chrysler research scientists and engineers then returned to their original objective--the automotive gas turbine engine. In the early 1950's, experimental gas turbine power plants were operated on dynamometers and in test vehicles. Active component development programs were carried out to improve compressors, regenerators, turbine sections, burner controls, gears, and accessories.

Here they faced many challenges: fuel consumption had to be competitive with conventional engines; components had to be small and highly efficient; noise had to be in the tolerable range; engine braking was a necessity, and the acceleration time-lag had to be reasonable.

In addition, readily available and non-strategic high temperature materials had to be developed, exhaust gas temperatures had to be low, and development work had to meet the requirements of building an engine which would be light, compact, reliable, easy to maintain and, from the cost aspect, competitive with the conventional automobile engines.

In spite of these difficult requirements, Chrysler research engineers were convinced that the potentialities of the automotive gas turbine engine were more than sufficient to warrant intensive research and a full-scale design and development program.

Today, it is obvious that the advantages of the gas turbine over the conventional engine are, indeed, real. Some of these advantages are:

- Maintenance is reduced considerably
- Engine life-expectancy is much longer
- Development potential is remarkable
- The number of parts is reduced 80%
- Tuning-up is almost eliminated
- Low-temperature starting difficulties are eliminated
- No warm-up period is necessary
- Antifreeze is not needed
- Instant heat is available in the winter
- The engine will not stall with sudden overloading
- Engine operation is vibration-free
- Operates on wide variety of fuels
- Oil consumption is negligible
- Engine weight is reduced
- Exhaust gases are cool and clean

THE FIRST TURBINE CAR

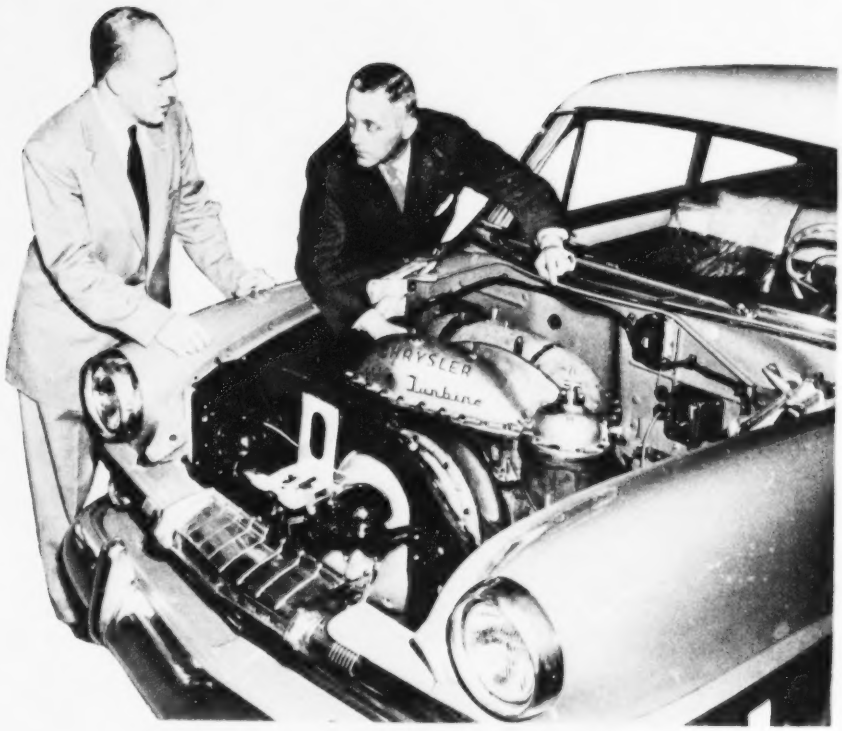
March 25, 1954 was a very important date in automotive gas turbine history: Chrysler Corporation disclosed the development and successful road testing of a 1954 production model Plymouth sport coupe which was powered by a turbine engine. The same car was on display from April 7 through 11 at the Waldorf-Astoria Hotel in New York City. And, on June 16, 1954, it was demonstrated publicly at the dedication of the Chrysler Engineering Proving Grounds near Chelsea, Michigan.

1954 PLYMOUTH TURBINE GETS A PROVING GROUNDS WORKOUT

This car marked the first attempt by an American automotive firm to install a gas turbine engine in a production automobile.

The engine was rated at 100 shaft horsepower. Although built essentially as a laboratory development tool, it was considered to be "a milestone in automotive power engineering" because it embodied solutions to two of the major problems long associated with vehicular gas turbines--high fuel consumption and scorching exhaust gas.

The key feature which contributed to removing these technical barriers was the revolutionary new heat exchanger, or regenerator. It extracted heat from the hot exhaust gases, transferred this energy to the incoming air, and thus lightened the burner's job of raising the gas temperature. The result was conservation of fuel as well as lower exhaust temperatures.



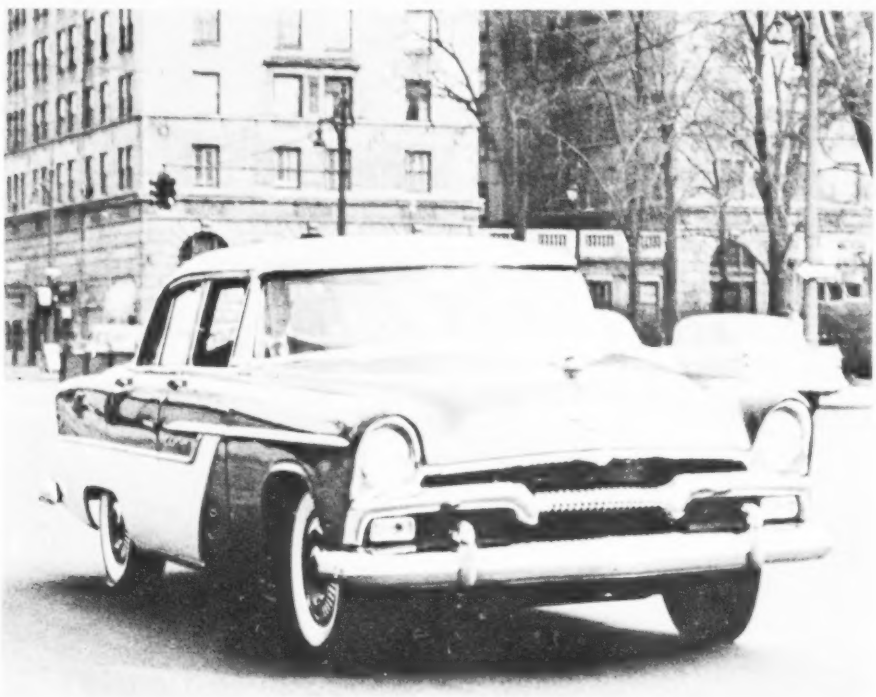
TURBINE ENGINE FITS NEATLY INTO 1954 PLYMOUTH

A gas turbine engine without a regenerator would have required several times the amount of fuel normally used in a regenerator-equipped engine. The extra fuel would be required to heat the gases to operating levels.

The regenerator also performed another important function. It reduced the exhaust gas temperature from about 1200 degrees F at full engine power to a safe level of less than 500 degrees F. Even more important, at idle the temperature was reduced to 170 degrees F. By the time the gases pass through the exhaust ducts to the atmosphere, the temperature was reduced even further.

Even with these breakthroughs, a great deal of work and many development problems still remained. On the date of the original turbine disclosure (March 24, 1954), Chrysler Corporation stated: "Whether we ultimately shall see commercial production of gas turbines for passenger cars depends on the long-range solution of many complex metallurgical and manufacturing problems. There is no telling at this time how long it will take to solve these problems."

Almost a year later, the same basic engine was installed in a 1955 Plymouth. This car, although never displayed at public exhibits, was used for driving evaluation tests on Detroit area streets.



DETROIT TRAFFIC TEST FOR 1955 PLYMOUTH TURBINE

THE 1956 CROSS-COUNTRY ENDURANCE TEST

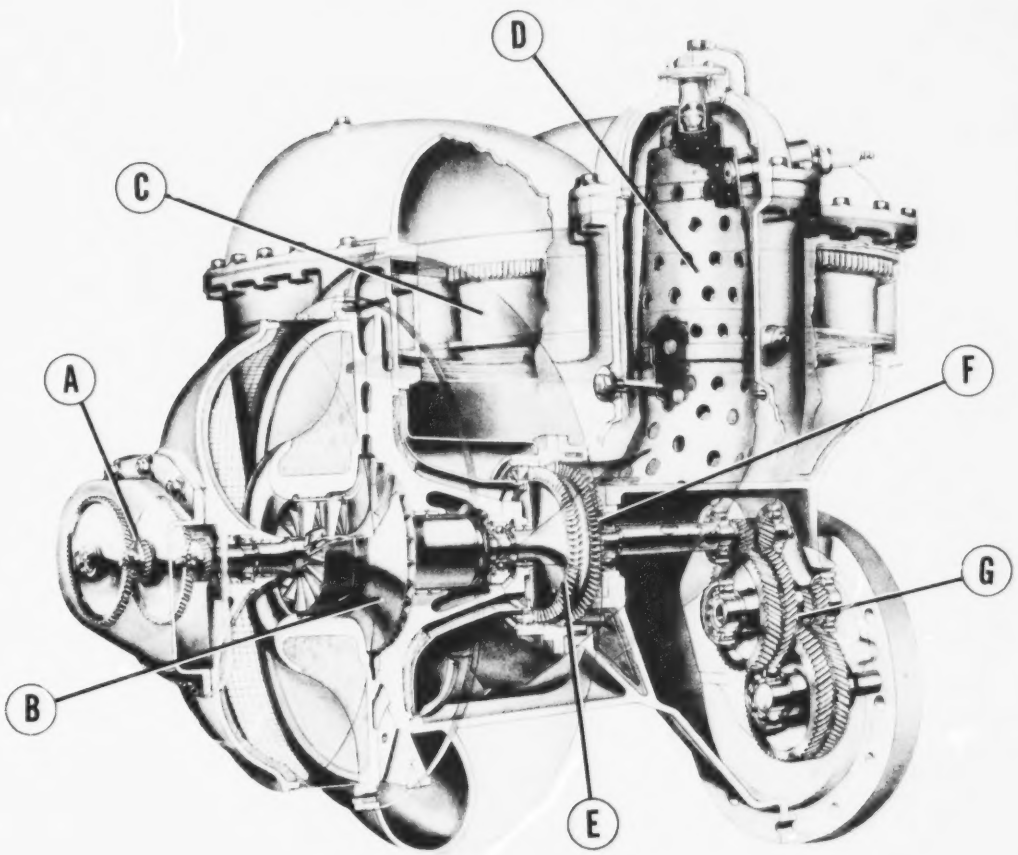
In March, 1956, another historic event took place--the first transcontinental journey of an automobile powered by a gas turbine engine.

1956 TURBINE SPECIAL EN ROUTE CROSS-COUNTRY

The turbine car--a four-door 1956 Plymouth sedan, a standard production model in every respect except for the revolutionary Chrysler-developed power plant--departed from the Chrysler Building in New York City on March 26. On March 30, four days and 3,020 miles later, it completed the cross-country endurance test when it arrived at the City Hall in Los Angeles, California. The purpose of the run was to test the turbine's durability, acceleration, fuel economy, control in traffic, action on steep grades, and operation under various climatic conditions. It marked another Chrysler Corporation "first" in the automotive record books and was considered a successful test.

Over the entire trip, fuel economy averaged approximately 13 miles per gallon using mostly "white" (unleaded) gasoline and some diesel fuel. The run was interrupted only twice for minor repairs which did not involve the turbine engine (a faulty bearing in the reduction gear and an intake casting were replaced). The engine itself and its basic components performed very well and without failures of any kind.

The experimental turbine engine was essentially the same as the one tested previously in the 1954 Plymouth. However, it reflected progress in the following major points: engine friction was greatly reduced; considerable work had been done with plain bearings instead of more expensive types of antifriction bearings; the combustion system was improved, and engine controls were developed further. Automatic controls allowed the driver to operate the turbine car just as he would a conventional automobile.



MAIN COMPONENTS OF THE FIRST GENERATION GAS TURBINE ENGINE were: (A) Accessory Drive Gears; (B) Compressor Impeller; (C) Regenerator; (D) Combustion Chamber; (E) First-Stage Turbine, which drives the compressor impeller and accessories; (F) Second-Stage Turbine, which supplies power to the transmission; and (G) Double-Stage Reduction Gearing to the transmission.

THE SECOND GENERATION TURBINE

Basing their calculations on extensive test data and performance results of the 1956 cross-country trip, Chrysler engineers designed and developed a second engine. After extensive laboratory tests, it was installed in a standard production 1959 Plymouth four-door hardtop.

1959 PLYMOUTH TURBINE SPECIAL READY FOR ROAD EVALUATION

In December, 1958, this latest Turbine Special made a 576-mile test run from Detroit to New York. The results showed significant improvements in fuel economy.

This second generation turbine (also a laboratory development tool) operated in the 200 horsepower range; and, although it was improved in almost every respect, two areas were particularly outstanding--efficiency and materials.

Three major engine components (compressor, regenerator and burner) showed significant improvements in operating efficiency. The compressor efficiency was brought u

to 80 per cent, a 10 per cent increase. The regenerator or heat exchanger unit reclaimed almost 90 per cent of the heat energy in the exhaust gas whereas peak efficiency in the 1956 cross-country run was around 86 per cent. Burner efficiency also was improved so that it was approaching the point of ideal combustion.

Less apparent, but fully as important as the engine design advances, was the progress in turbine metallurgy. Prior to this time, automotive turbine metals were similar to those used in aircraft jet engines. Although these existing materials certainly were adequate for test engines, they would not be suitable for automotive production for two key reasons: cost, and the simple fact that neither production capacity nor the available world supply of the required alloying materials could support such a program.

Through Chrysler metallurgical research, new materials were developed which: contained plentiful and relatively inexpensive elements; could be fabricated by conventional means; and had excellent resistance to heat and oxidation at elevated temperatures. Applications for these new materials were combustion chamber liners, turbine wheels and blades, etc.

The accompanying illustration shows a three-inch disc of the new material (left), with a disc of high-grade stainless steel (right). Both samples were exposed in air to temperatures above 2,000 degrees F in an electric furnace for 150 hours. At the end of that time, the new Chrysler-developed material showed no distortion or disintegration, while the effect on the stainless steel sample is apparent.

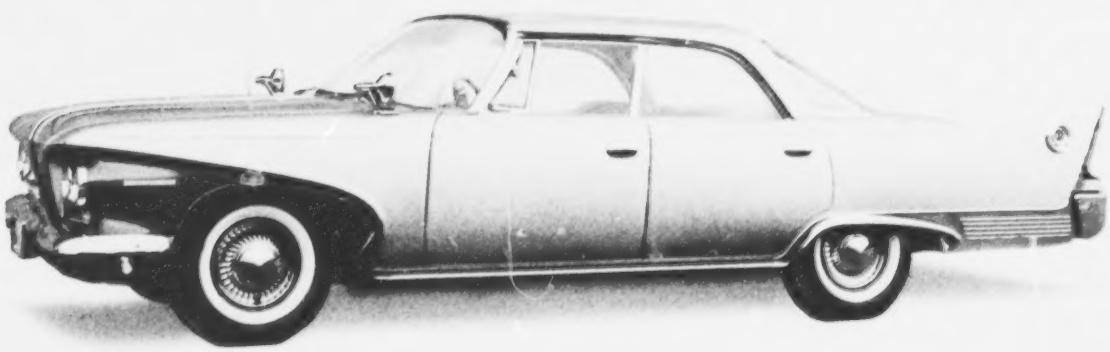
METALLURGICAL BREAKTHROUGH

A TRIO OF GAS TURBINE VEHICLES

Encouraged by previous progress, Chrysler engineers designed the third generation of the turbine and introduced it in three different vehicles. The initial showing was to newsmen on February 28, 1961. The vehicles were displayed publicly in Washington, D. C., March 5-9, 1961, in conjunction with the Turbine Power Conference of the American Society of Mechanical Engineers, co-sponsored by the Department of Defense.

TURBOFLITE--ADVANCED POWER, ADVANCED STYLING

The first of these gas turbine vehicles was an experimental sports car called the "Turboflite" (shown above). In addition to the engine, other advanced ideas of the car were the retractable headlights, a deceleration air-flap suspended between the two stability struts, and an automatic canopied roof. This "idea" car received wide public interest and was shown at auto shows in New York City, Chicago, London, Paris, etc.



1960 TURBINE-POWERED PLYMOUTH

The second of the vehicles was a 1960 Plymouth (shown on the previous page) which was standard in every respect except for the engine and minor exterior styling modifications.

The final member of this trio was a two-and-a-half-ton Dodge truck which was a standard production vehicle--except for its gas turbine engine. This application demonstrated the turbine's versatility and adaptability because the engine in this truck was basically the same as those in the passenger cars.

TURBINE POWER FOR 1960 DODGE TRUCK

AN IMPORTANT PHASE OF RESEARCH AND DEVELOPMENT

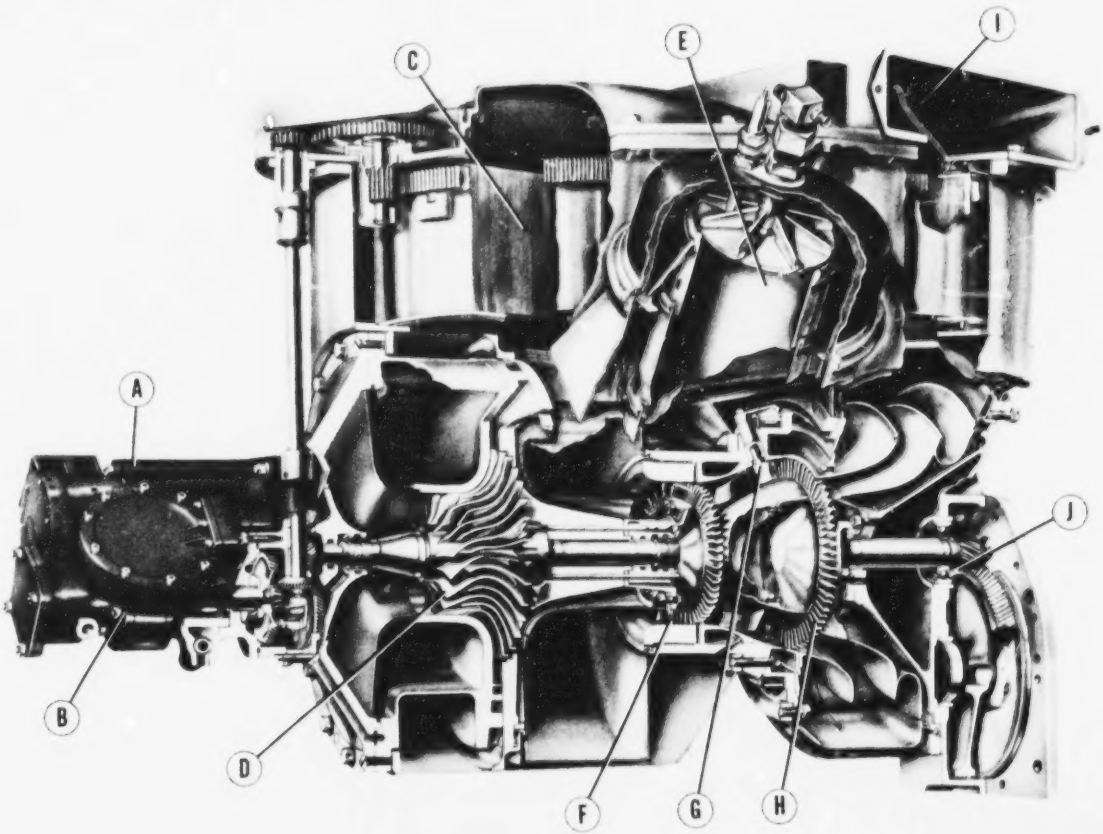
After months of test and development work, a CR2A gas turbine engine was installed in a modified 1962 Dodge.

Called the Dodge Turbo Dart, styling modifications to the car were adapted to reflect its radically different power plant. The bladed wheel motif of the grille and wheel covers reflected the appearance of the vital components of the gas turbine.

COAST-TO-COAST TEST VEHICLE — 1962 DODGE TURBO DART

The car left New York City on December 27, 1961, to begin a coast-to-coast engineering evaluation. After traveling 3,100 miles through snowstorms, freezing rain, sub-zero temperatures and 25 to 40 mile per hour head winds, it arrived in Los Angeles on December 31.

The turbine had not only lived up to all expectations but had exceeded them! An inspection showed every part of the engine in excellent condition. Fuel economy was consistently better than a conventional car which traveled with the turbine car and was exposed to the same conditions.



MAIN COMPONENTS OF THE CR2A gas turbine are: (A) the starter-generator; (B) fuel pump; (C) regenerator; (D) compressor impeller; (E) combustion chamber; (F) first-stage turbine, which drives the compressor impeller and accessories; (G) variable second-stage nozzle; (H) second-stage turbine which supplies power to the driveshaft; (I) one of two exhaust outlets; (J) single-stage helical reduction gear of 8.53-to-1 ratio which reduces power turbine rpm of 39,000 to 45,730, to a rated output speed of 4,570 to 5,360 rpm.

SPECIFICATIONS OF CHRYSLER CORPORATION'S MODEL CR2A GAS TURBINE ENGINE

GENERAL

Type: Regenerative gas turbine

* Rated Output: Power - 140 bhp @ 4,570 rpm output shaft speed
Torque - 375 lb-ft @ zero rpm output shaft speed

Weight: 450 lbs

Basic Engine Dimensions (without accessories): Length - 27 inches
Width - 35 inches
Height - 27 inches

With automotive accessories in place, the over-all length is: 36 inches

Fuels: Unleaded gasoline, diesel fuel, kerosene, JP-4, etc.

COMPONENTS

Compressor: Type - Centrifugal
Stages - One
Pressure Ratio - 4:1
Efficiency - 80%

First Stage Turbine: Type - Axial
Stages - One
Efficiency - 87%

Second Stage Turbine: Type - Axial
Stages - One
Efficiency - 84%

Regenerator: Type - Single rotating disk
Effectiveness - 90%

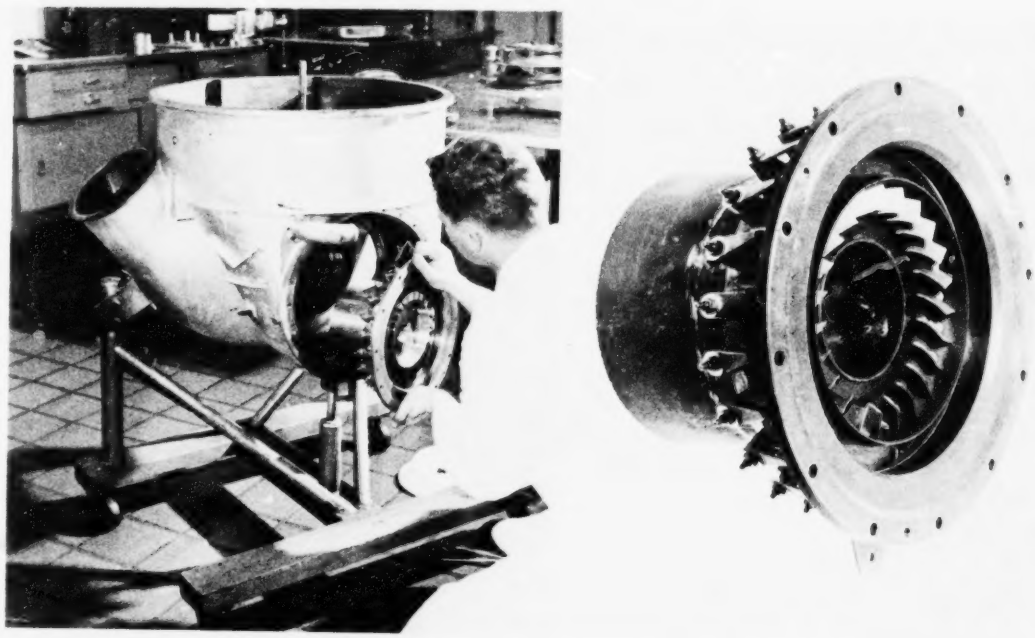
Burner: Type - Single can, reverse flow
Efficiency - 95%

* DESIGN POINT CHARACTERISTICS

Maximum Gas Generator Speed - 44,600 rpm
Maximum Second Stage Turbine Speed - 45,700 rpm
Maximum Output Speed (after reduction gears) - 5,360 rpm
Maximum Regenerator Speed - 17 rpm
Compressor Air Flow - 2.2 lb/sec
First Stage Turbine Inlet Temperature - 1700°F
Exhaust Temperature (full power) - 500°F

* Ambient conditions: Temperature - 85°F; Barometric Pressure - 29.92 in. Hg

The key to the excellent performance and economy of the third generation gas turbine (called the CR2A) was its new variable turbine nozzle mechanism.



THE VARIABLE NOZZLE MECHANISM is installed by a research engineer in the rear of the CR2A-turbine engine housing (left). The nozzle mechanism (right) acts in shutter fashion to provide engine braking, improve acceleration and increase fuel economy by controlling and directing the angle of the jet stream to the power turbine blades.

The automatic second stage turbine nozzles provided optimum results throughout the entire operating range of the engine. Thus, economy, performance, or engine braking could be maximized as required by the driver. For example, one area of performance is what is termed acceleration lag--the time it takes the compressor section to reach operating speed after the accelerator pedal is depressed. The first turbine engine had an acceleration lag of seven seconds from idle to full-rate output; the second engine required three seconds to achieve maximum vehicle acceleration, while this new engine required less than one and one-half seconds to accomplish the same performance.

CONSUMER REACTION TOURS

Another experimental turbine-powered car--the Plymouth Turbo Fury--joined the Dodge Turbo Dart, and the two turbine-powered cars began extensive consumer reaction tours at dealerships throughout the country in cities such as Los Angeles, San Francisco, Kansas City, St. Louis, Cleveland, Detroit, Chicago, etc. Two other turbine cars, a second Dodge and a second Plymouth, were added during the month of April in order to expand coverage of the tours. All four cars were powered by versions of the CR2A turbine engine.

1962 TURBINE TWINS

The tour schedule was similar in each area. When the cars arrived in a given city they were first displayed to members of the local press. The press events involved explaining the turbine and answering questions, giving each newsman a ride in one of the cars, and, in some cases, staging special tests. After members of the press had viewed the cars, they were then displayed at various dealerships.

One of the key reasons for these tours and exhibits was to elicit and evaluate consumer reactions to the turbine. The cars were shown at Plymouth and Dodge dealerships in approximately 90 major cities in the United States and Canada.

STOPOVER POINTS ON CONSUMER REACTION TOUR

During this time hundreds of thousands of people came to see the turbine vehicles, and public interest was intense and serious. When asked, "if this car were offered for sale to the motoring public, do you think you would buy one?" 30 per cent of the turbine viewers said "yes" they would definitely buy one and 54 per cent answered they would think seriously of buying one.

As a result, on February 14, 1962, Chrysler Corporation announced that it would build 50 to 75 turbine-powered passenger cars which would be available to selected users by the end of 1963. Typical motorists would be offered an opportunity to evaluate turbine cars under a variety of driving conditions.

On February 14, 1962, in Chicago, Chrysler Corporation exhibited another gas turbine vehicle--the Dodge Turbo Truck. This medium-duty truck (also equipped with the CR2A experimental engine) had just completed a 290-mile test run from Detroit to Chicago.

TURBINE PULLING POWER TESTED IN 1962 DODGE TURBO TRUCK

From February 17 through 25, three gas turbine-powered vehicles (the Plymouth, Dodge, and Dodge Truck) were exhibited at the Chicago Automobile Show.

On March 7, 1962, George J. Huebner, Jr., Executive Engineer of Research for Chrysler Corporation, received an award from the Power Division of the American

GEORGE J. HUEBNER, JR. RECEIVES AWARD FOR
GAS TURBINE LEADERSHIP

Society of Mechanical Engineers "for his leadership in the development of the first automotive gas turbine suitable for mass-produced passenger automobiles." It was the first such award ever given to an automotive engineer.

A TURBINE CAR FOR PUBLIC EVALUATION

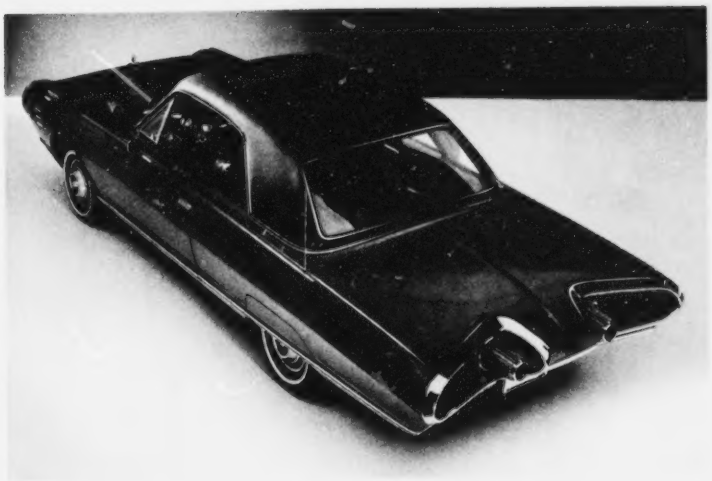
May 14, 1963 was an eventful day in the history of automotive design--the Chrysler Corporation Turbine Car was unveiled to newsmen at the Essex House in New York City. On the same day a ride-drive program for newsmen was held at the Roosevelt Raceway on Long Island. Newsmen were permitted to drive the vehicle around a 2.5-mile course. And, on May 15, the car was viewed at the Waldorf-Astoria Hotel in New York City by Chrysler Corporation dealers in the Metropolitan New York area.

These events signalled the public launching of Chrysler Corporation's program of building 50 turbine-powered cars and placing them in the hands of typical drivers for evaluation in everyday use.

This program was an outstanding point in the history of turbine vehicles for two key reasons. First, this was the first time any company had committed itself to build a significant number of gas turbine vehicles. (In the past, gas turbine installations generally were limited to one or two test vehicles.) Second, for the first time, turbine-powered automobiles would be driven and evaluated by private individuals outside the corporation. (Previously, only research specialists and a few automotive writers had been permitted to drive the turbine-powered cars.)

The Turbine Car is a completely new automobile. Since the sole purpose is to determine the reaction of typical American drivers to turbine-powered vehicles, the engine

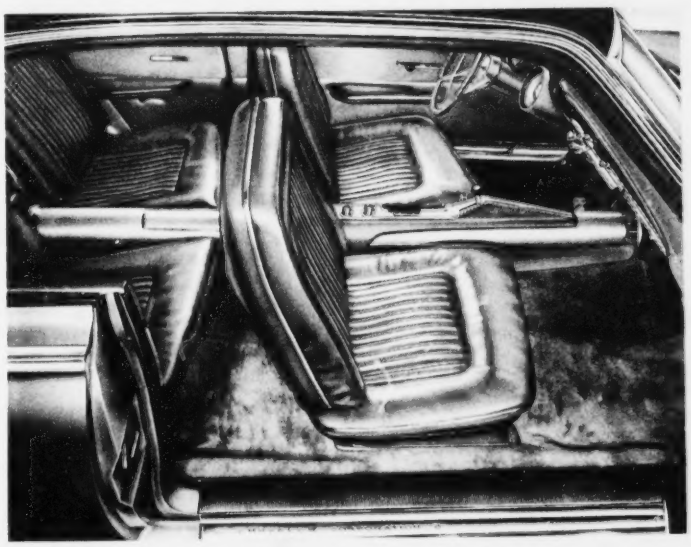
A COMPLETELY NEW CAR



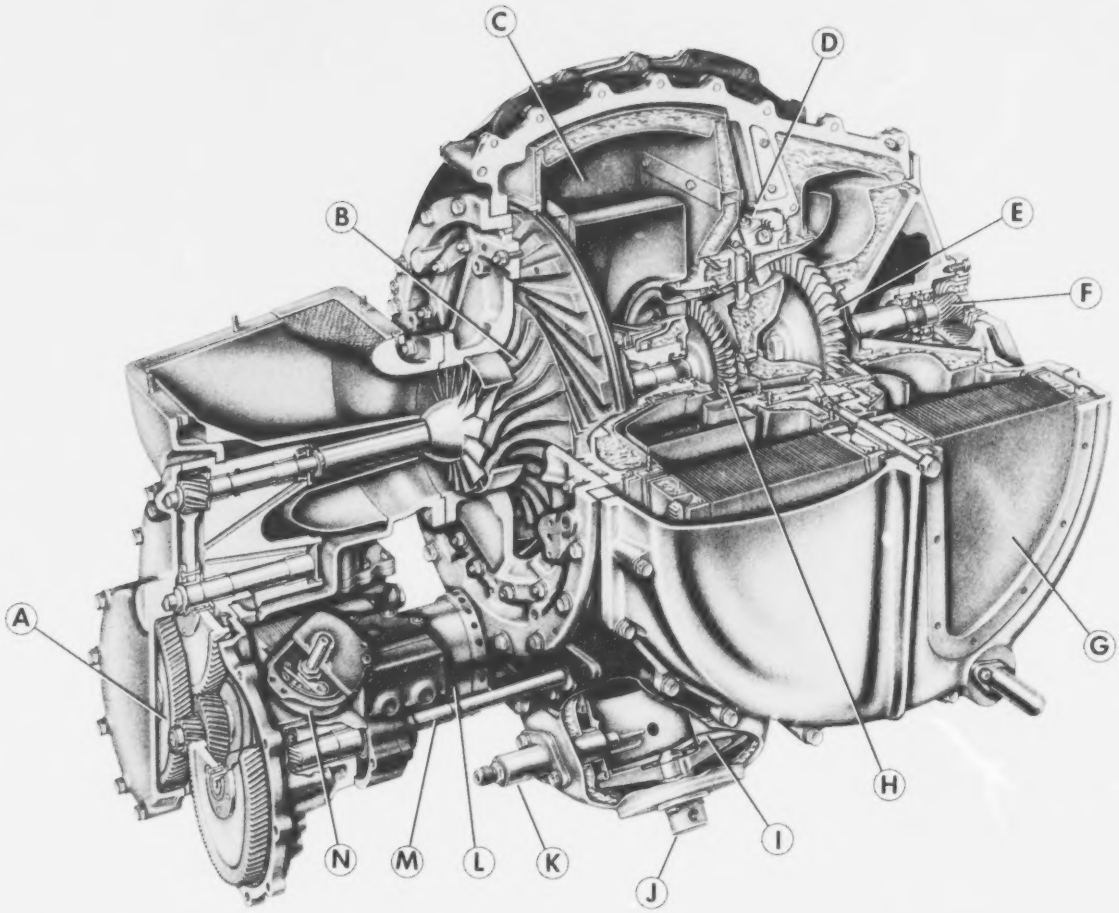
REAR VIEW EMPHASIZES AERODYNAMIC STYLING

has been placed in a family-type car designed for everyday use which forms a familiar evaluation background for the driver. The styling theme is designed to provide an exciting setting for the vehicle itself. The over-all impression is a fresh styling appeal with strong emphasis on a contemporary and luxurious appearance. Ornamentation is based on the bladed turbine motif which is characteristic of the engine. The interior features a full-length center console and extensive use of leather.

The Turbine is offered as one body style -- a 4-passenger, 2-door hardtop. The exterior and interior are available in one color -- turbine bronze. Power steering, power brakes, power window lifts, automatic transmission, and all other available equipment are standard.



LUXURIOUS INTERIOR APPOINTMENTS
OF THE TURBINE CAR



MAIN COMPONENTS OF THE TWIN-REGENERATOR GAS TURBINE:
(A) accessory drive; (B) compressor; (C) right regenerator rotor; (D) variable nozzle unit; (E) power turbine; (F) reduction gear; (G) left regenerator rotor; (H) gas generator turbine; (I) burner; (J) fuel nozzle; (K) igniter; (L) starter-generator; (M) regenerator drive shaft; (N) ignition unit.

The turbine power plant for the car is an entirely new design, more advanced in concept than the previous Chrysler turbines. It is Chrysler Corporation's fourth generation turbine power plant design. It has a new configuration with two regenerators rotating in vertical planes (one on each side) and a centrally located burner. Compared to the previous model CR2A, the new engine is more lively, lighter, more compact, and quieter. Acceleration lag (see page 15) is reduced to slightly over one second. And, of particular interest, the new engine design is more adaptable to production techniques.

SPECIFICATIONS OF CHRYSLER CORPORATION'S GAS TURBINE ENGINE

GENERAL

Type: Regenerative gas turbine

* Rated Output: Power - 130 bhp @ 3,600 rpm output shaft speed
Torque - 425 lb-ft @ zero rpm output shaft speed

Weight: 410 lbs

Basic Engine Dimensions (without accessories): Length - 25 inches
Width - 25.5 inches
Height - 27.5 inches

With current accessories in place, the over-all length is: 35 inches

Fuels: Unleaded gasoline, diesel fuel, kerosene, JP-4, etc.

COMPONENTS

Compressor: Type - Centrifugal
Stages - One
Pressure Ratio - 4:1
Efficiency - 80%

First Stage Turbine: Type - Axial
Stages - One
Efficiency - 87%

Second Stage Turbine: Type - Axial
Stages - One
Efficiency - 84%

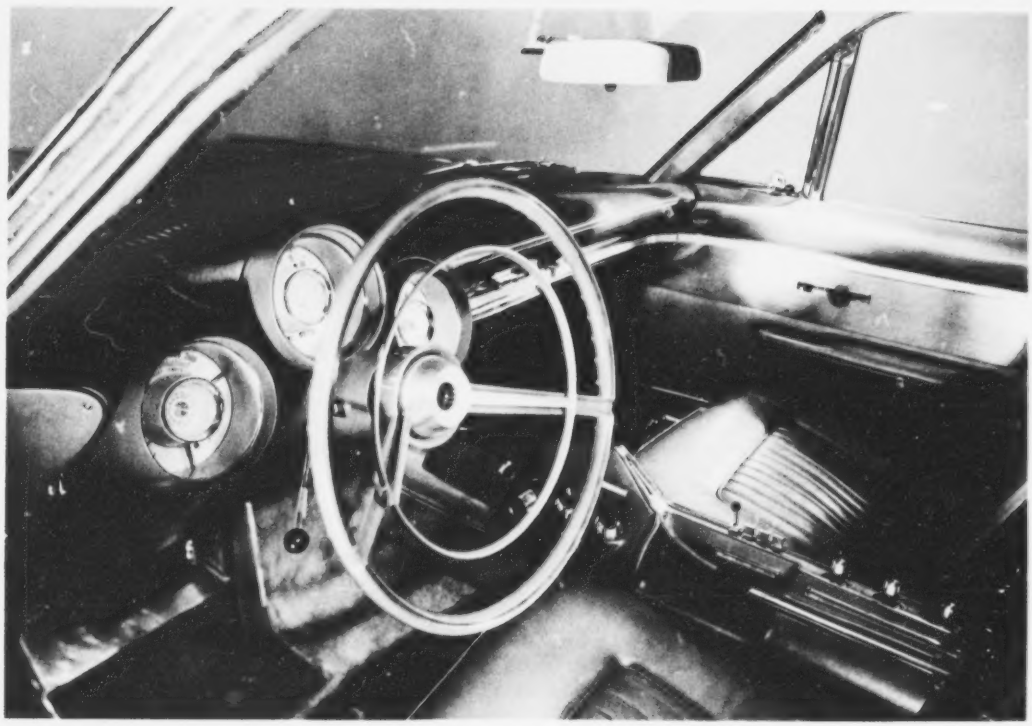
Regenerator: Type - Two rotating disks
Effectiveness - 90%+

Burner: Type - Single can, reverse flow
Efficiency - 95%

* DESIGN POINT CHARACTERISTICS

Maximum Gas Generator Speed - 44,600 rpm
Maximum Second Stage Turbine Speed - 45,700 rpm
Maximum Output Speed (after reduction gears) - 4,680 rpm
Maximum Regenerators Speed - 22 rpm
Compressor Air Flow - 2.2 lb/sec
First Stage Turbine Inlet Temperature - 1,700°F
Exhaust Temperature (full power) - 500°F

* Ambient conditions: Temperature - 85°F; Barometric Pressure - 29.92 in. Hg



INSTRUMENTATION AND CONTROLS

The operation of the Turbine Car is much the same as that of a car with a piston engine and an automatic transmission.

To Start - Place the transmission shift lever in the "Idle" location and push down to engage the "Park/Start" position. Turn the ignition key to the right and release it--starting is automatic. Within a few seconds, the inlet temperature and tachometer gauges on the instrument panel will read about 1700°F and 18,000 rpm, respectively, indicating that the engine is started.

To Drive - Place the transmission in "Low", "Drive", or "Reverse" (as with a conventional car), release the parking brake, and the car is ready to drive. Push the accelerator pedal to go, release it to reduce speed, and press the brake pedal to stop.

To Park - Bring the car to a complete stop, place the transmission lever in the "Idle" location and push it down to engage the "Park/Start" position, apply the parking brake, and turn the ignition key to the "off" position.

The present performance and economy of the Turbine are comparable to a conventional car with a standard V-8 engine. The engine will operate satisfactorily on diesel fuel, kerosene, unleaded gasoline, JP-4 (jet fuel), and mixtures thereof. And, even more interesting, it is possible to change from one of these fuels to another without any changes or adjustments to the engine. The users of the cars also will appreciate the many other advantages of the turbine engine (see summary list on page 2).

DRIVING THE TURBINE IS AN EXCITING EXPERIENCE

The Chrysler Corporation Turbine Car will be built at the rate of one each week until the fall of 1964, when the last of the 50 cars is expected to be completed. The special facilities for building these limited production cars are located at Chrysler Corporation's Engineering Research Laboratories in Detroit. At the assembly area, the Chrysler-designed car bodies, which are built by Ghia of Italy, are lowered onto the new engines and chassis components. The turbine engines are built and tested at Chrysler's Research Laboratories.

The objective of the program is to test consumer and market reaction to turbine power and to obtain service data and driver experience with the turbine cars under a wide variety of conditions. Each selected user will drive the car for a period up to three months under a no-charge agreement. The car then will be reassigned to other users to provide a broad consumer sampling base. In total, the 50 cars will be distributed to about 200 motorists on a rotating system over a two-year period.

CHRYSLER PRESIDENT TOWNSEND VIEWS
THE FIRST TURBINE CAR ASSEMBLY LINE

Users of the turbine-powered passenger cars are being selected by the accounting firm of Touche, Ross, Bailey and Smart. Under the user selection procedure, Chrysler gives the accounting firm the date and metropolitan area location of each planned delivery, which is geared to the turbine production schedule. Random selection of user candidates for each location is then made by the accounting firm according to the selection and distribution criteria specified by Chrysler to meet market test objectives.

To qualify initially as a turbine prospect, a candidate must own a car (or, be a member of a household in which a car is owned by the head of the household) and must have a valid driver's license.

Turbine candidates are being picked as follows:

1 - From Chrysler's letter inquiry file which currently contains 25,000 names. These applications were in the form of unsolicited letters from people in hundreds of cities in all 50 states (and 15 countries). Requests range from that of a 12-year-old boy asking that his father be given a car to that of an 83-year-old retiree.

2 - From major population centers in the 48 continental United States. Chrysler specified this to assure a high degree of market exposure to turbine-powered vehicles and to test the cars in a variety of geographical areas and in all kinds of weather and terrain.

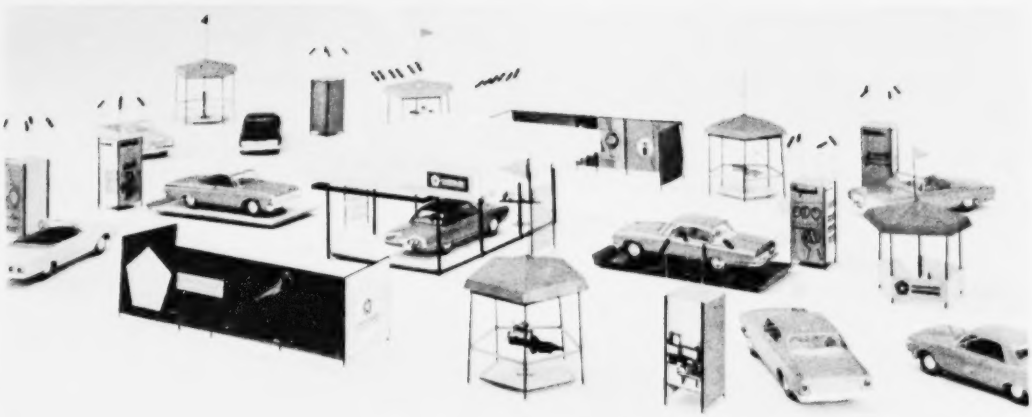
3 - In accordance with the make, price category and age of the new and used cars owned by candidates at the time they wrote their letters to Chrysler. In this respect, the program intent is to select users whose car ownership pattern will reflect the great variety of the types and ages of cars on the road today.

In return for the use of the turbine car, each user is being asked to furnish Chrysler with information needed for the market evaluation program. In general, Chrysler handles the service, insurance and other costs involved in the use of the turbine car. Each user buys the fuel for driving it. He also is expected to maintain the physical appearance of the car, exercise reasonable care to protect it from damage, and supervise its use by others. And, in the event of some difficulty, he is instructed to report the situation to a turbine service representative.

The world's first consumer delivery of a turbine car took place October 29, 1963 in Chicago. Mr. Lynn A. Townsend, president of Chrysler Corporation, presented the keys to the turbine car to Mr. and Mrs. Richard E. Vlaha of Broadview (a Chicago suburb). Typical of the 200 scheduled deliveries, the presentation was observed by newsmen and reported in various newspapers, magazines, and on radio and television.

The objective of this program is to learn just how this new kind of car performs in the hands of typical drivers and in typical everyday usage--on long trips and short trips--and over a wide range of climatic conditions and terrain.

FIRST CONSUMER DELIVERY OF
A TURBINE CAR

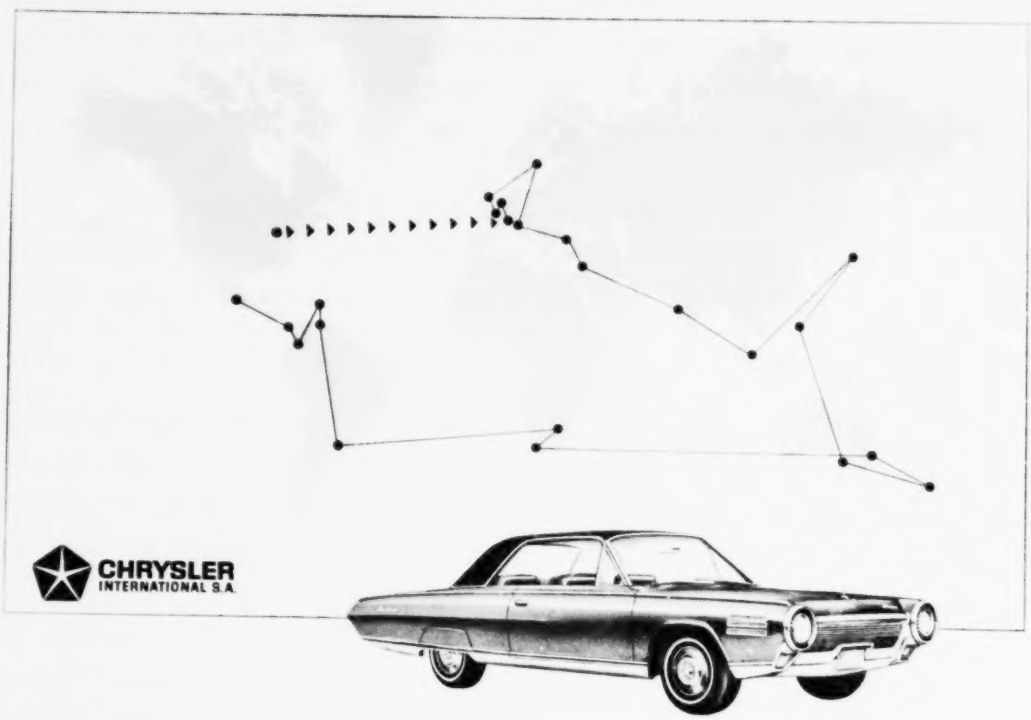


MODEL OF SHOPPING CENTER TURBINE EXHIBIT

In addition to the user evaluation program, a traveling exhibit began visiting large shopping centers across the United States in January, 1964. The exhibits include a turbine car, turbine engine displays and regular production Chrysler Corporation products. Each stopover is scheduled for several days or weeks and is announced in local newspapers. Chrysler representatives accompany the exhibits and explain the turbine and Chrysler's program to interested visitors.

TYPICAL SCENE AT SHOPPING CENTER EXHIBIT

A turbine car also was taken on a world tour. From September 12, 1963 through January 8, 1964, the car was shown in 23 cities in 21 countries. The 47,000-mile journey by a chartered aircraft included stopovers in Geneva, Paris, London, Turin, Bombay, Singapore, Tokyo, Sydney, Cape Town, Buenos Aires, and Mexico City.



WORLD TOUR OF TURBINE CAR

Throughout all aspects of the consumer evaluation, shopping center exhibit, and world tour programs, Chrysler is trying to get reactions from the general public--from the millions of people who will drive, ride and view this new kind of car. This evaluation, Chrysler emphasizes, is designed to generate the information needed as the basis for decisions regarding the direction that should be taken in the turbine program. It is a necessary piece of research concerning the size and characteristics of the potential market for this new kind of automobile. And since it is a test--an experimental market-research project--it has no pre-ordained outcome.

A LOOK TO THE FUTURE

The preceding information has summarized the progress made in Chrysler turbine vehicles of the past and present. However, the story would not be complete without a brief glance to the near future. During the forthcoming months, experts at Chrysler will be busy analyzing consumer reactions to the car and doing further work on manufacturing techniques required for possible production. When this phase is completed and if all results are encouraging, the turbine will have completed its full evolution--from a research dream to a production car.

In the space of ten years, Chrysler Corporation research and engineering has been able to develop a power plant that can compete with and, in some respects, perform better than the piston engine which has been in automotive use nearly three-quarters of a century.

Moreover, although the progress of the gas turbine and its advantages are impressive, Chrysler Corporation engineers are confident that they have by no means reached the full design potential of this engine. Additional progress in improved component efficiencies (particularly in the compressor) and the future possibility inherent in increased operating temperatures, are extremely promising. For example, a 400-degree increase in nozzle inlet temperature would mean a 40 per cent increase in specific output for a given-size power plant, or conversely, a reduction in size for a fixed horsepower. The same 400 degrees increase would improve fuel economy over 20 per cent without needing to take advantage of any further increase in component efficiency. Chrysler Research scientists, who are working with materials that will make this possible, feel that the problems associated with these higher temperatures do not appear any more difficult than the problems already solved.

The tremendous potential of the turbine to satisfy the characteristics desired in a power plant fires the imagination and the energy of Chrysler engineers. They feel that the turbine has great promise for propelling automobiles more smoothly, more economically, and more dependably.

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